

## **ARLEIGH BURKE (DDG 51) CLASS GUIDED MISSILE DESTROYER WITH THE AEGIS WEAPON SYSTEM, AN/SPY-1D/D(V) RADAR AND AN/SQQ-89(V) INTEGRATED SURFACE SHIP ANTI-SUBMARINE WARFARE COMBAT SYSTEM**



The *Arleigh Burke* (DDG 51) class of multi-mission, battle force capable guided missile destroyers provides precision engagement of targets ashore, full-dimensional protection of joint and allied forces, and dominant maneuver in the open oceans and littorals around the globe. DDG 51s are being constructed in flights to incorporate technological advancements during construction. Flight I (DDG 51-71) and Flight II (DDG 72-78) configurations are described in prior year reports. This report focuses on early Flight IIA ships with the AEGIS Baseline 6 Phase I computer program (DDG 79-84), which are now entering the Fleet. The AEGIS Weapon System (AWS), which includes the SPY-1D radar and SM-2 surface-to-air missiles, provides the ship's area air defense capability. The Phalanx close-in weapon system, SM-2 missiles, and 5-inch gun provide self-defense against anti-ship missiles. For anti-submarine warfare (ASW), DDG 51 uses the AN/SQQ-89 surface ASW combat system, two embarked Light Airborne Multi-Purpose System (LAMPS) MK III helicopters, torpedoes, and vertically launched ASW standoff weapons. Surface warfare weapons include the 5-inch gun and LAMPS MK III helicopters armed with Penguin or Hellfire missiles. TOMAHAWK missiles and the 5-inch gun are used to engage shore targets. Four LM 2500 gas turbine engines provide power for a maximum speed in excess of 30 knots. Data Link connectivity to other Navy, Joint, and Allied forces is provided via Links 4A, 11, and 16.

The SPY-1D radar system is a multi-function, phased-array, three-dimensional (range, altitude, and azimuth) radar that conducts search, automatic detection, and tracking of air and surface targets. The SPY-1D also provides mid-course guidance for the SM-2 missile. AN/SPY-1D(V), a new variant under development for installation in later Flight IIA ships, is expected to improve performance against targets in clutter and have greater ability to counter deceptive electronic attack measures.

The AN/SQQ-89(V) series of ASW combat systems links acoustic sensors and weapon control systems with advanced data processing and information displays. The AN/SQQ-89(V)6, which is installed in Flight I and Flight II DDG 51 class ships and other combatants, is the baseline system for ships with a towed array. It integrates the AN/SQS-53 series hull mounted sonar, the AN/SQR-19(V) Tactical Towed Array Sonar, and the AN/SQQ-28(V) LAMPS MK III shipboard electronics with the ASW Control System MK 116 series. For Flight IIA DDG 51 class ships, the AN/SQQ-89(V)10 removes the AN/SQR-19 towed array, while (V)14 reorganizes the functional segments, and (V)15 introduces a

COTS-based system. Eventually, A(V)15 will replace the AN/SQR-19 on Flight I and II ships with the new Multi-Function Towed Array.

## **BACKGROUND INFORMATION**

DDG 51 has an extensive OT&E history. DOT&E's FY91 report contains a complete summary of OT conducted prior to commissioning of the lead ship. The results of the first at-sea testing of the Flight I ship, conducted in DDG 51, were detailed in DOT&E's FY92 report. Subsequent FOT&E, which reexamined the ship's ASW effectiveness and the Gun Weapon System was discussed in DOT&E's FY94 and FY96 reports. The results of FOT&E of the Flight II variant were reported in DOT&E's FY00 report. Overall, Flight I and II DDG 51 class ships and the AN/SPY-1D radar are assessed to be operationally effective and suitable. The Flight I LFT&E Program, which included a 1994 Shock Trial and a 1995 Total Ship Survivability Trial, is complete. Flight II ship design survivability will be assessed as part of the Flight IIA LFT&E Program.

DOT&E assessed the AN/SQQ-89(V)6 ASW combat system installed in the DDG 51 class ship to be operationally effective and operationally suitable. The SQQ-89(V)6 Torpedo Alertment Upgrade was assessed to be neither operationally effective nor operationally suitable. Previous AN/SQQ-89(V) testing, including recent FOT&E of the Torpedo Alertment Upgrade, is described fully in the FY00 Annual Report.

## **TEST & EVALUATION ACTIVITY**

DDG 51 OT activity in FY01 was dedicated to preparation for FOT&E (OT-IIIIE) of the Flight IIA DDG 51. Revision 9 of the DDG 51 TEMP was approved by DOT&E in October 2001 to support this testing. Conducted in October 2001 aboard USS *Roosevelt* (DDG 80), OT-IIIIE evaluated the performance of a Flight IIA ship with the AEGIS Baseline 6.1.3 configuration. Testing was conducted during the USS *John F. Kennedy* (CV 67) Battle Group Composite Training Unit Exercise at the Atlantic Fleet Weapons Training Facility. DOT&E and COMOPTEVFOR are analyzing the data collected during OT-IIIIE with a final report due in January 2002. Flight IIA FOT&E will continue during FY02 with test events in USS *Winston S. Churchill* (DDG 81), USS *Lassen* (DDG 82), and USS *Bulkeley* (DDG 84). FOT&E will include assessment of the AEGIS Baseline 6.1.5 configuration and DDG 51's capability to defend against multiple fast patrol boat attacks using all available weapons. FOT&E will also be conducted in USS *Cole* (DDG 67) to evaluate the performance of the AEGIS Baseline 5.3.8 computer program, which is being installed in Flight I and Flight II ships. A second phase of land-based AN/SPY-1D(V) DT/OT will be conducted in FY03.

During FY01, DOT&E participated in the revision process for the AN/SQQ-89 ORD and TEMP. DOT&E's objective is to ensure that testing of the AN/SQQ-89(V)14 and future variants and DDG 51 Flight IIA is coordinated and adequately addresses critical ASW issues. In particular, since the Torpedo Alertment Upgrade was determined to be not operationally effective or suitable in its FY00 FOT&E, DOT&E will continue to monitor the torpedo detection performance of future variants closely and will continue to advocate realistic OT in that area.

Two key LFT&E events were conducted during FY01. The Flight IIA Total Ship Survivability Trial was conducted in January 2001 aboard USS *Oscar Austin* (DDG 79). A Shock Trial was conducted during May and June 2001 aboard DDG 81. The Navy is currently evaluating the results of both of these tests. The LFT&E effort is highly dependent on modeling and simulation. During FY01, the Navy

accredited several models for the DDG 51 LFT&E Program, including the Naval Research Laboratory's Radar Target Signature Model, CRUISE\_Missiles Simulation, ShipIR Ship Infrared Signature Model, IR\_CRUISE\_Missiles Simulation, and the Johns Hopkins University Applied Physics Laboratory's AEGIS Weapon System Models Network. Accreditation of several other models is in progress. Navy and DOT&E personnel have also been involved in analysis of damage to the USS *Cole*.

## **TEST & EVALUATION ASSESSMENT**

Based on testing up through FY00, Flight I and II DDG 51 class ships and the AN/SPY-1D radar are assessed to be operationally effective and suitable. An assessment of Flight IIA with the AEGIS Baseline 6.1 configuration will be included in the FY02 report.

The DDG 51 Program Office does not have the resources to support robust dedicated FOT&E events, making it necessary for COMOPTEVFOR to seek out opportunities to combine OT with other evolutions, such as DT and fleet training exercises. DDG 51 FOT&E was conducted during fleet training exercises in FY00 and early FY02. The Report of the Defense Science Board Task Force on Test and Evaluation Capabilities noted that combining OT with training has both benefits and drawbacks. Planning for the FY02 test event once again highlighted the difficulty of informally coordinating the needs of trainers and testers. In particular, operational testers were given little advance information about the scenarios for the upcoming events and had no input to the planning process or control over the flow of events. This made it difficult to assess the adequacy of the test to achieve the stated objectives. The Navy's training and test organizations need to formalize procedures for combined events in order to afford operational testers early access to the planning process and better coordinate T&E objectives with training objectives.

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